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# RHUBARB IN ALBERTA

BY

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# RHUBARB IN ALBERTA\*

BY

J. S. SHOEMAKER

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## Introduction

Rhubarb, or pieplant, is a perennial that grows well under cultivation throughout most of Alberta providing it receives proper attention. Though described as a vegetable, and sometimes made into pickles, it is generally used as a fruit. It comes very early in the spring and has fine dietetic qualities.

Rhubarb is one of the most popular of the early spring vegetables. Not only is it available during the outdoor production season, but the practice of winter forcing, and the possible commercial use of the quick-freezing process of storage, makes it available to the consumer throughout the year. It may be kept for home winter use by the cold-pack method of pressing it into jars until it is covered with its own juice, by preserving in sugar or honey, or in other ways known to the housewife.

Because rhubarb is a perennial it should be planted at one side or end of the garden. Fifteen to twenty plants will provide plenty of leafstalks (petioles) for all the requirements of the average family without danger of weakening any one plant by too severe harvesting.

The plants will definitely benefit by the choice of a well-sheltered site where snow will lie in winter. Experience has also shown that in the chinook areas of southern districts of the province where the ground is often bare for one or two months in midwinter even in protected locations, the new spring growth will invariably be vigorous providing the soil had been thoroughly soaked by irrigation water in the previous autumn.

## Botanical and Historical Considerations

The scientific name of common rhubarb is *Rheum rhaponticum*. It belongs to the *Polygonaceae*, or Buckwheat or Knotweed, family, and is the only member of this family cultivated as a vegetable, though the wild docks and sorrels, of the genus *Rumex*, are sometimes used as greens.

The French for Rhubarb is Rhubarbe; the German, and Scandinavian, Rhubarber; the Italian, Rabarbaro; and the Spanish, Ruibarbo.

"The medicinal use of Rhubarb dates from very early times, the earliest known records being that found in the Chinese herbal of PENKING, about 2700 B.C. It

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\*Grateful acknowledgment is made to the following for suggestions in the text: Chas. Walkof, Experimental Farms Station, Lethbridge; R. M. Adamson, Experimental Farms Station, Morden, Man.; J. F. Moore, Experimental Farms Sub-Station, Beaverlodge; A. Wilson, Provincial School of Agriculture, Vermilion; P. D. Hargrave, Provincial Horticultural Station, Brooks; R. Simonet and Geo. Harcourt, Edmonton; Thos. A. Graham, McFayden Seed Co., Winnipeg, Man.; H. R. Murray, Macdonald College, Que.; John H. Coulter, R.R. 5, Winnipeg; and Mrs. G. F. Chipman, 132 Montrose St., Winnipeg, Man.



is probable that the knowledge of its medicinal properties spread westward from China to Arabia, where it was listed in the medicinal lore of the Arabs as a purgative and tonic, and from thence through the near East to Europe. Pliny knew it as the *Rhacoma* root, believed to grow beyond the Pontus, and the drug which was derived from the dried root seems to have been the same as that used by Dioscorides, physician to Antony and Cleopatra. He wrote of it as 'Rhia or Rheon, the Rhapontic root growing in the lands beyond the Bosphorus, from whence it is imported'. Celsus also wrote of the *Radix pontica* as the root imported from the banks of the river Rha. Paulus Aeginata was amongst the first to employ it as a purgative, and by the beginning of the Christian era it was in common use in Roman and Greek medicine. Marcellinus, writing in the fourth century, stated definitely that the Rha was a river, on the borders of which grew a plant which carried the same name and whose root was famous in medicine. The Rha is now identified as the River Volga.

"The name, Rhubarb, may most probably have been derived in this way. *Rha* from the river which gave its name to the plant growing on its banks and *barbarum* from the barbarian district beyond the immediate confines of the Roman Empire. This would suggest *Rha-barbarum*, the plant from the barbarian countries. As many of the roots were imported from the Pontus district this may have been the source of the term *Rhaponticum*. Both Buibourt and Geiger thought that the two names might have been used independently to designate two different sources, viz. *Rha-ponticum*, the plant from the regions of the Pontus Euxinus and *Rha-barbarum*, that derived from Tartary, then included in the Roman category of barbarian. As it is now believed that the so-called Chinese or Tartary Rhubarb was first brought to Europe by Marco Polo in the 13th century, their premise is doubtful, although the prepared material, as imported was never uniform. There is also some evidence of the use of *Rheu*, a root, thus suggesting *Rheu-barbarum* or *Rha-barbarum*, the root from the barbarian country. A Greek derivation is also possible, based on the Gr. *rheo*, I flow, whereby the purgative nature of the drug may have been emphasized. Parkinson, who suggested several alternative derivations for *Rha-barbarum*, concluded that the word was a linkage between the Greek *Rha* and the Roman *barbarum*, designating a plant from remote nations. He inclined to the opinion that the plant took its name primarily from the river *Rha* but did not overlook the possibility of derivation from the Arabic from which the name *Raued* or *Rhaved*, frequently used in the Near East, might have arisen. The early English herbals referred to the plant as *Rhapontic* or *Rheubarbe*, regardless of the place of origin, and it is from the latter term that the version *Rhubarb* is finally derived." (Turner, D. M. The Economic rhubarbs: a historical survey. Jour. Royal Hort. Soc., Aug., 1938.)

Astrologers place rhubarb with the group of herbs governed by Mars.

Flowers small, white, borne on short-jointed pedicels. The floral envelope consists of the calyx or perianth, without a corolla; it dries up after maturation but remains attached to the base of the fruit. The flattened, rather triangular-bodied fruit contains a single seed.

The stigma is 3-lobed and is not receptive until after the anthers have shed their pollen. As Jones and Rosa (1928) point out, because of the prevailing protandry (shedding of pollen before the stigma is receptive), self-pollination within the individual flowers cannot occur, but pollen may fall from the upper flowers, which open later, to the stigmas of the lower ones. Unsuccessful efforts to obtain seed from single isolated plants indicate that some plants at least are self-sterile. Protandry and self-sterility favor cross-pollination, and the variable plants produced by seed indicate hybrid ancestry.

Chromosome numbers in *Rheum*, so far as known, are 11 for the species *emodi*, *officinale*, *palmatum*, and *speciforme*, and 22 for *rhaponticum*, *undulatum*, and *crassinervium*.

## Climate

Rhubarb crowns and rhizomes are resistant to cold and to dry conditions, both of which induce dormancy. In regions with dry summers and mild winters, the rhubarb is dormant in the summer and grows during the winter and early spring. In cold regions, the plant is dormant during winter and produces its best product in the cool weather of early spring, but with plenty of moisture can be kept growing throughout the summer. Its successful culture is mostly restricted to the northern part of the world, where the summers are cool and moist and the winters sufficiently cold to freeze the ground to a depth of at least 3-4 inches. Although the underground portion of the plant is extremely frost hardy, the leaf portion is unable to withstand a temperature below 25°F., and exposure to lower temperatures may ruin the crop for several pickings.

## Varieties

No rhubarb variety at the present time breeds true from seed; hence in a lot of seedlings of any so-called variety, there will be large plants and small plants, red stems and green stems and all sorts of intermediates. Significant factors involved in the variation that occurs when rhubarb is grown from seed are: (a) the pollen is shed before the female part of the flower is receptive; (b) partial to nearly-complete self-sterility (which requires that cross-pollination occur for seed production); (c) although *Rheum rhaponticum* is the commonest species, it may be a development of a number of sub-types which differ enough to have formerly been classified as species.

To get plants of a definite type, one should either divide an old clump of the desired type or else raise a large number of seedlings and select from them the plants which have the desired qualities. But now that improved varieties are available at low cost it is best to buy plants to start.

Comparatively small stalks with a good red color are preferred by most people. Cool temperatures during the growing season are conducive to the highest development of rich, red color in the leaf petioles; high temperatures tend to produce green-colored stalks in old varieties.

*Macdonald*: Originated at Macdonald College, Que. Stalks of good size, juicy, fine-grained; skin deep red, thin; flesh pinkish. The flavor and fibre of the stalks are excellent and when cooked the product is of an attractive pink color. It requires less sugar for cooking than any of the old varieties. Sends up seedstalks but seems to produce only a little seed.

The description filed with the Canadian Horticultural Council, Plant Registration Bureau, with which the variety was registered in 1925, is as follows:

"Seedling of Victoria rhubarb, selected for its rich red color both on the exterior of the stalk and in the interior, and for its earliness and productiveness. The stalks are broad and thick averaging 1" across by  $\frac{3}{4}$ " thick. The stalks have a slightly V shaped face and the back is rounded and decidedly channelled. The leaves are large, cordate and broader than long, slightly roundish and without a point. The leaves are savoyed and are wavy at the edges. The average measurements of the leaf and stalk from young strong plants are as follows: diameter of leaf 21"; color (Ridgways Color Standards), base of stalk, rose red, stalk, carmine to garnet brown ranging to pompeian red towards the leaf and shading of  $\frac{1}{3}$  to  $\frac{2}{5}$  up the large

veins of the leaf blade. The internal color of the base of the stalk (sliced stalk), is a pale rose red with white veins, in the centre of the stalk are rose red patches on a geranium pink ground. The expressed juice stains white paper a deep rose pink when wet, and in drying changes to a rose pink or amaranth pink. The foliage is softly or minutely covered with very fine hairs, and in color compares with Varleys Green".

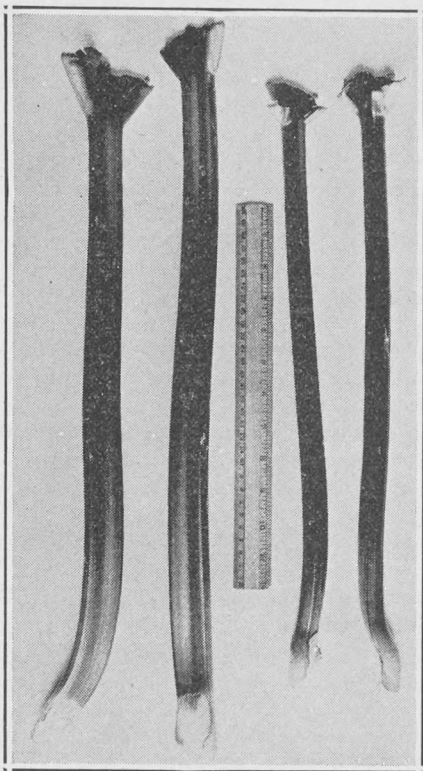


Fig. 1—Two varieties of rhubarb: right, Macdonald; left, Ruby.

*Ruby*: Originated at Central Experimental Farm, Ottawa. Has a smaller stalk than Macdonald but the stalks are more numerous. About two-thirds of the length of the stalk, the skin is a ruby red color and about two-thirds of the flesh is of the same rich color and of fine grain. The red color is due to a speckling of small red dots which are most numerous at the base of the stem, gradually thinning out towards the top. Ruby can be distinguished from Macdonald by this character. Ruby is of slightly better flavor than Macdonald and slightly less acid requiring a little less sugar for cooking. Produces a quantity of seed. A fairly high percentage of the seedlings are of a good type. Possibly more subject to a crown rot than is Macdonald.



✓ *Mammoth Red*: A rank grower, with stalks rather numerous, short and thick, and deep red in color. The texture and flavor are not so good as in smaller sorts, but it has a very attractive appearance and is a heavy cropper. It is an excellent forcing variety.

✓ *Victoria*: An old variety that responds well to forcing and has rather surprisingly good color when grown in darkness. The outdoor stalks do not have the rich color of Macdonald or Ruby or the same degree of sweetness. Good strains of Victoria, however, can be developed. A moderately prolific seed-bearer. Gives a low percentage of good seedlings.

*Early Sunrise*: Originated at Dominion Experiment Station, Kentville, Nova Scotia. Stalks are reported to be thicker and more robust than its parent Ruby, to be well-flavored, and colored right to the leaves.

*Coulter*: Originated with John H. Coulter, R.R. 5, Winnipeg, Man. Roots of it are to be made available on the market in 1940. A seedling of Macdonald and selected because of three outstanding features: (a) the weight and length of stalk similar to its parent; (b) the color of stalk is dark red instead of bright red like the parent; (c) the flesh is colored a bright red from the butt end of the stalk to the leaf when the stalk is 9 inches or more long. Before attaining that length the stalk has no color. This is said by a number of people who have seen it to be a very promising new variety.

When the late Geo. F. Chipman, Editor of the Country Guide, started a garden for experiments at Charleswood, near Winnipeg, rhubarb was one of the first kinds of plant set out. He set out Macdonald, Ruby, and one or two plants of a large green variety Green Giant. From the Macdonald and Ruby he saved pounds of seed and planted it. Each year he saved the seed from the best seedlings and grew thousands of plants. *Canada Red* is a seedling of Macdonald with many of the parent characteristics. It makes a strong plant, is a vigorous grower, and has better color than Macdonald. The stalk is red right through and is a deep rich red when cooked. *Shortcake* is a seedling of Ruby. It does not make so strong a plant as Macdonald, but the stalk is of excellent texture and color. The name is associated with the fact that a good shortcake has been made from stalks of this variety. A third Chipman seedling has been named *Red Emperor*. It promises well but is not yet generally available.

*Strawberry* and *Minnokin* are perhaps notable in withstanding drouth. Some other varieties are Sutton's Seedless, Hobdays Giant, Wagner Giant, Riverside Giant, Linnaeus, and German Wine.

### Soil and Fertilizer

Rhubarb is the strongest feeder of all vegetables. It needs a deep, rich soil. Usually the richer the soil, plus plenty of water, the better the results. A spot where manure has been piled, or any similar extremely rich place, is ideal. A good plan is to summerfallow the land the season before rhubarb is to be planted to aid subsequently in weed control; manure may be worked in before the summerfallow.

For a garden plot the soil should be spaded to a depth of 12-16 inches, and rotted manure, leaf-mold, decayed hardwood leaves, sod (free from

couch), or some other form of organic matter should be mixed with it. While it is important that fibrous material high in "plant food" be incorporated into the soil in which the rhubarb roots are to be planted, it is advisable to keep the manure or whatever material is used from coming in direct contact with the crown or roots. The cause of root rot or poor root development has often been traced to the caustic action of manure or the air spaces around the roots which were caused by strawy substances. (See also under Moisture Conservation.)

The planting should be topdressed with a heavy application of manure, either after harvesting is completed, or in autumn, at the rate of 10-30 tons per acre. A good plan is to make a trench or furrow in the alleys between the rows, place manure in it, and then water well (to give the effect of liquid manure). The trench should be covered with soil. Fresh horse manure applied over the hills of established plants during early spring greatly hastens growth or "forces" the plants. Some feel that horse manure, which is warm and light, should be applied to heavy (cold) soils, and cow or hog manure, which is cold and comparatively heavy, should be applied to sandy (warm) soils.

In the absence of manure the plants can be mulched with green grass or weeds, and commercial fertilizer may be applied liberally, but *some manure is very desirable*. On highly organic soils, such as peat, it is possible to grow good rhubarb without manure, but liberal applications of fertilizer each season are necessary. There should be plenty of "plant food" available to the plant after the cutting season to enable it to store up a reserve supply in its roots for next season's crop.

If plenty of manure can be obtained, rhubarb needs little if any commercial fertilizer. If manure is scarce, it may be supplemented with a commercial fertilizer, the amount varying with the manure used and the fertility of the soil. Commercial fertilizer (particularly if manure is not available) should be applied both in the spring and at the end of the harvest season. About  $\frac{1}{4}$ - $\frac{1}{2}$  pound of a fertilizer high in nitrogen and phosphorus applied around each hill is a good application.

There seems to be little evidence or experience to indicate any significant value from potash applications to rhubarb on most Alberta soils. Hence, it is just as well and more economical to use a nitrogen-phosphorus fertilizer than to use a "complete" one which provides potash.

A good rule is to apply a nitrogen fertilizer (such as ammonium sulphate) in the spring, and follow this with a somewhat heavier application of a nitrogen-phosphorus fertilizer (such as ammonium phosphate) in late June or shortly after harvesting of the stalks is completed for the season. The summer application encourages the building up of a strong reserve for the following season.

A browning of the edges of rhubarb leaves has been correlated by Carolus with potash deficiency. If such symptoms become noticed on rhubarb plants in Alberta then attention can be given to special applications of potash.

## Propagation

New plants may be obtained: (a) from seed, (b) by breaking up old established crowns.

In the first method, the seed may be sown in hotbeds or cold-frames in early spring and the seedlings so produced transferred to nursery rows in the open field in early summer. Where a greenhouse is available to start the seed, a temperature of 55°-60°F. gives highest germination. The seedlings may be pricked-out, 3 inches apart, into flats and, once established, be hardened-off in a cold-frame before they are set out in the field.

Seed may be drilled in fairly thickly in rows, 18 inches, or more, apart, in the open ground as early as the soil can be prepared and the seedlings thinned in the rows. For normal root development it is wise to thin the young seedlings to 6 inches apart under dry land conditions and to 3 inches apart if they are grown on irrigated land. When cutworms are a menace, as is often the case, thinning should be delayed until after the

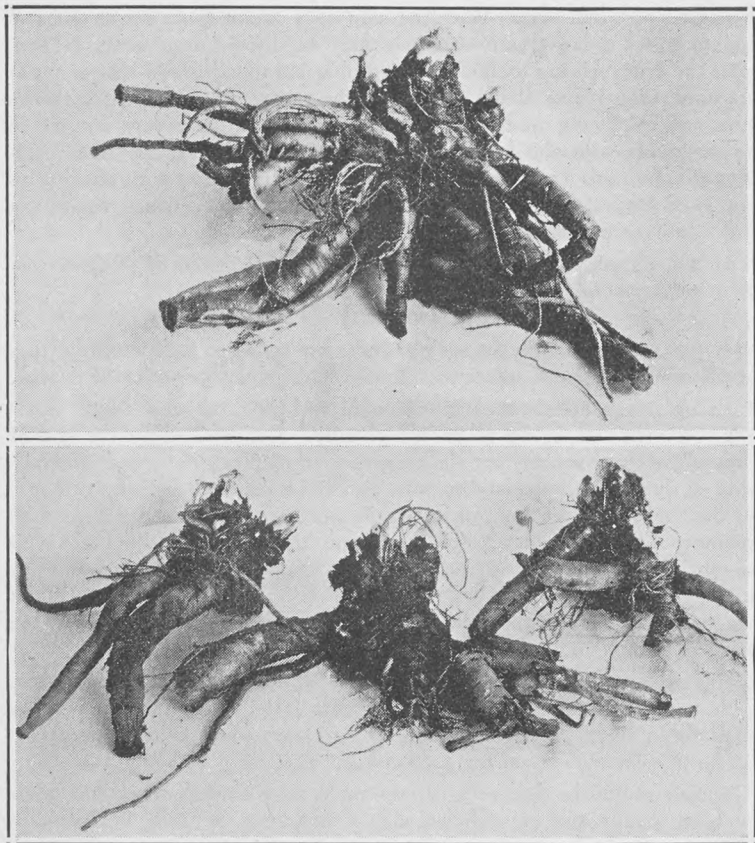


Fig. 2—A 3-year-old root (above) propagated by division (below).

third week in June. As a rule, it requires a year's more time to produce stalks from seeds than from root divisions, even under the congenial environment of irrigated land. Propagation from seed rarely proves satisfactory because seed usually produces only a small percentage of plants like the mother plant. Few varieties come true to type from seed.

The use of crown divisions, rather than seed, is recommended. The pieces for planting are obtained by dividing the crowns, preferably when dormant in the fall or early spring, leaving as much root as possible with each strong eye or bud. The crowns may be cut into as many pieces as there are buds. Two to four buds with a fair-sized piece of rhizome (the fleshy underground storage organ) attached gives quicker and better results than single bud cuttings. The root divisions may be portions of young plants or quite old plants (6-8, or even 10 years) of a good strain or variety. In the latter case the sturdy outside portions only should be used for propagation material; discard the centre of the plant.

Prof. John Walker, University of Manitoba, has outlined the operation of making root divisions: "With the help of a strong sharp knife and two digging forks, a big clump or crown may be divided into many crowns. After the crown is dug it should be carefully examined to see how it might best be divided. The fleshy portion of the crown should be cut with the knife, and by placing the two forks back to back with the prongs inserted in the cut made with the knife and slowly prying them apart, strong undamaged divisions can be obtained. By dividing a large crown in this way, each portion will have a full complement of roots, which would not be the case were a spade used for splitting the crown."

If the crowns are allowed to wilt slightly before cutting better root divisions may be obtained.

## Planting

If planting is done in the spring, and early spring is a dependable time, the plants should be set before the roots or buds have produced new growth.

Fall planting also is usually successful and, in fact, often best. Some time is gained and strong plants are obtained quickly. About the end of August gives opportunity for the development of fresh roots and establishment of the plants, but planting may usually be done successfully throughout September or even somewhat later if weather conditions are favorable; even very late fall planting does not harm the new sets. Rhubarb roots are much like peony roots in some respects, re-establishing themselves more quickly during the cool fall days. With fall-planted roots, some stalks may be pulled late in the following season, which is never the case after spring planting.

Regardless of the time of planting the soil should be reasonably moist. A thorough soaking of water immediately after planting is advisable, especially in areas of scant rainfall. If irrigation water is available this is a definite recommendation for good cultural practice.

A hole should be dug, or a furrow made, wide enough to accommodate the roots readily and of sufficient depth that when planting is completed the uppermost buds are about 2-3 inches below the soil surface. The bud scales should just show. If the buds are planted too deeply, decay will

result. The soil should be firmed well (with the feet) around the roots, but the top few inches should be left loose. Broken and bruised roots generally are cut off, and long, whippy roots cut back before planting. If the roots are planted behind the plow it is a good practice to cut them to a uniform length beforehand. Some gardeners feel that whenever the roots are cut that the cut surfaces should be dusted with lime or be permitted to heal over for several hours before planting.

### Spacing

The spacing of rhubarb plants depends upon such factors as area involved, method of cultivation, whether irrigation is practised, and the mature plant size of the variety grown. In the northern and central part of the province where soil moisture is generally not a limiting factor, the plants are spaced 3-4 feet apart each way. In the non-irrigated sections of the central and southern plains, at least 5 feet should be allowed between plants. On irrigated land, close spacing is generally the rule in order to use the land to the greatest advantage and accordingly the plants of small-growing varieties are set 3 feet apart each way while the large varieties such as Macdonald are spaced 4 feet apart each way.

### Moisture Conservation

Cultivation is largely confined to the control of weeds and preventing crust formation. The rhubarb bed needs digging, or a similar practice, each spring to freshen the surface and remove any weeds or grass. Thorough stirring of the soil at frequent intervals is a good practice. The root system of rhubarb extends in the soil 3-4 feet laterally and to a considerable depth, filling the surface layer with fine absorbing roots, consequently cultivation should be shallow.

Large amounts of water are used by the large leaves and stems, therefore moisture conservation is of great importance. Soon after the ground is frozen it is well to cover the ground with strawy manure. Instead of mulching in this manner, another method is to hill up the rows by means of a plow and then apply a light mulch of manure. These ridges are worked down during early spring and the manure incorporated in the soil. In many cases an application of strawy manure is made to the rows in early spring or immediately after the ridges are worked down. This material protects the plant from cold and encourages early growth. Mulching of this character often is done in lieu of the yearly application of manure.

Prior to the advent of very hot, dry weather in midsummer, a mulch of 2-3 inches of well-rotted manure may be placed around the plants (not on the crowns). The following spring this may be lightly worked into the soil and a new much again applied in midsummer.

In some cases, a hardpan subsoil makes it difficult to grow rhubarb which is a deep-rooting plant. Digging a deep hole and filling it with manure, bones, etc., and then planting rhubarb on top of this "trenched-in" material will prove disastrous in drouth periods. A better plan is to turn the blower on the threshing machine towards the farm garden and blow up to 2 feet of straw on the rhubarb plot. A heavy mulch of manure or



straw (plus application of nitrogen fertilizer) helps to counteract the shallow rooting necessitated by a very heavy subsoil.

A site infested with grass or where there are tree roots is not a good place to plant rhubarb.

Where rhubarb is grown under irrigation conditions it is felt that while shallow cultivation should be practiced during the harvest or pulling season, a deep cultivation followed by a thorough irrigation after the pulling season is over is beneficial. By cultivating deeply many fine feeder roots are destroyed and a great number of feeders are thereby encouraged to take their place so that a strong reserve may be built up in the plants during the remainder of the season.

### **Irrigation**

When a permanent crop such as rhubarb is to be grown under irrigation, due consideration must be given to the lay of the land prior to planting. The land must be free of knolls and depressions so that the water will run from one end to the other uniformly and not pond. If the job of levelling is too much for a man with a shovel, a team and scraper are useful.

In rhubarb culture, furrow or row irrigation is the most practical method. It is important that the water should not be permitted to touch the plants and should run uninterrupted from the top to the bottom of the row. To do this effectively the soil is cultivated lightly and then shoved or scraped toward the plants so that a shallow furrow is formed. This prevents the water from puddling and subsequently causing the soil to bake near the plants. Just as soon after irrigation as the top soil is dry enough to permit the use of the cultivator, it should be stirred lightly to prevent crust formation.

The most reliable method of determining the need of applying irrigation water is the hand-pressure soil test. This consists of digging near the plants to the depth of a shovel blade and grasping a handful of soil from the bottom of the hole so formed. If the soil remains in a ball when the hand is opened, there is still enough moisture present to support plant growth. On the other hand, if the soil falls apart instead of balling, immediate irrigation is necessary.

As a rule rhubarb will do nicely with three thorough irrigations, one in June, one in July, and one in late autumn just before freeze-up. In fact, numerous irrigations are more beneficial to rhubarb, provided the water does not lie. In districts where the ground is bare for considerable periods during the winter, the late autumn irrigation is very desirable. The additional moisture of snow and rain also helps to provide the plants with adequate moisture to last until the following June.

The time required to irrigate a plot properly depends largely on the soil type. Heavy clay absorbs moisture much more slowly than a porous sandy soil. A slow trickle of water is also more effective than a large stream although it is a good practice to first of all flush water through the furrows with a good sized stream before the trickle is set. Generally the water is permitted to run until it has soaked well into the soil between the



plants. This is determined by running the shovel into the soil to a depth of 12-15 inches with only moderate pressure. A certain amount of waste water runs off the plot during a lengthy irrigation. This is utilized by guiding it on to another part of the garden.

### **Seedstalks**

Any factor that interrupts steady development during the growing period may cause seedstalks to appear. Low temperature, impoverished soil, drouth, excessive harvesting, and the variety are significant factors which affect seed production. Seedstalks should be removed as soon as they form, because seed bearing greatly weakens the plant, reduces the number of stalks, and results in activity of fewer buds or eyes. The seedstalks, while young, should be removed by gently pulling. Some think that if the seedstalks are broken off a poisonous substance may be formed and result in decay of the crown. If old seedstalks are pulled a large hole is left at the base and becomes a source of rot and other trouble. If an old seedstalk is cut or broken off and a part of it remains the result is often the production of a number of weak, slender leafstalks at its base the next year. These undesirable conditions emphasize the importance of removing the seedstalks while they are young. If one wishes to save seed it is necessary, of course, to leave some seedstalks.

### **Pulling**

No leafstalks (stalks or stems) should be pulled (harvested) until the second year and but few until the third. Moreover, the harvest season must be largely confined to early spring as the plants should be allowed to grow undisturbed during summer. The first harvest should not be longer than a period of 3-5 weeks. Later this may be extended to 6-8 weeks if the size of the petiole continues satisfactory. If harvested over too long a period the plant does not have sufficient time to store the necessary reserve food in its rhizomes.

Only the largest and best stalks should be harvested. The first-appearing leafstalks should be allowed to grow at least 9-12 inches before they are removed. The stalks should be pulled out, not cut. Cutting or breaking off the stalks aboveground makes open wounds which may serve as places of infection for disease or trouble from other causes. The leafstalks separate readily from the crowns and are easily harvested by grasping them near the base and pulling and twisting to one side in the direction in which the stalk stands (in the direction of growth). Stating this in other words, in harvesting it is advisable to grasp the leafstalks with the thumb and last three fingers and thrust the fore-finger down along the inside of the stalk below the surface of the soil in order to better detach the stalks from the crowns without breaking. This method leaves no stubs to decay. The smaller stalks are often thinned somewhat to permit better development of those remaining. Immediately after pulling, the leaf-blades should be severed at once, leaving 1-2 inches of the midribs with intervening tissues, and be kept out of the sun and wind; thus wilting of the petiole is reduced.

Rhubarb is usually ready for use at Edmonton about mid-May, and somewhat earlier in the southern part of the province. Its use for stewing

may be continued throughout the summer, providing there is new growth. After midsummer the advent of other garden products lessens the demand for rhubarb.

It is best to follow a systematic plan in harvesting, pulling all properly usable from each hill. This allows new growth to develop for another picking a week or ten days later. Such a practice will yield a greater amount of tender stalks than the promiscuous pulling without any reference to order. No plant should at any time be stripped of all its leaves and stalks, and at the end of the harvesting period the plants should continue to grow vigorously and produce leaves freely. This will insure an abundant storage of reserve food in the fleshy root before winter sets in.

On some markets the stalks are sold loose, while others require that they be washed, trimmed at the base, graded according to size and color, and tied in bundles. From 3 to 6 stalks will form a bunch, depending upon stalk size, season of year, and local market requirements.

After the market season of rhubarb is past the plants are allowed to grow as they will, except for the removal of seedstalks, which should be removed as soon as they arise in order to conserve the energy or strength of the plant for the production of foliage and roots. A heavy crop of rhubarb in any year depends to a large extent on the strong leaf growth of the year before, on moisture, and especially on the reserve food stored in the roots or crowns during the latter part of the season.

Too prolonged harvesting is unwise. Just before a severe frost in the fall, however, the leafstalks in a suitable condition for use may be harvested without adverse consequence to the plants.

### Grades

The grades for field rhubarb, according to The Fruit, Vegetables and Honey Act are as follows (1938):

*No. 1 Grade.*—"No. 1" shall consist of stalks showing not less than one-third red colour, and not less than  $\frac{3}{4}$  inch in diameter or  $2\frac{1}{2}$  inches in circumference at or near the butt end, a minimum length 10 inches over all, the stalks shall be fresh and not wilted, well trimmed, free from stalks pulled from the seed stem, disease, insect and other pests, dirt, trimmings and other foreign matter, and shall be well packed in packages constructed of sound material, clean and of such size as to hold not less than 42 pounds net when packed, except that field rhubarb may be packed in 11-quart veneer-baskets of minimum net weight 12 pounds.

Definition of Terms—"No. 1" Grade.

(i) "*Well packed*" means that the stalks shall be placed one way in the container, that is either all across or lengthwise of the package.

(ii) "*Well trimmed*" means that the butt shall be left uncut with the skin removed, and the top with slight prong not exceeding one inch in length, but in the event of the stalk being too long for the container, the *leaf end only* shall be cut.

*No. 2 Grade.*—"No. 2" shall consist of stalks free from decay.

In order to allow for variations incident to commercial grading, handling and packing, in No. 1 Grade, 10 per cent by count of any lot

may be below the requirements of the grade but not to exceed one-half of this tolerance shall be allowed for any one defect except that no decay or stalks below minimum length shall be permitted.

Forced rhubarb shall be advertised, displayed, sold, offered or had in possession for sale, only by weight or by the bunch weighing not more than seventeen ounces nor less than fifteen ounces.

### **Yield**

Good strong plants should produce about 3,000 bunches per acre per year. Another estimate is that an acre should yield 2 tons or 20,000 stalks.

Commercially, the profitable age of a well-cared for planting is about 5-7 years after the plants have been set into the field, making 3-5 years returns to the grower.

### **Renewal**

Since for two years after planting few leafstalks are harvested, a new rhubarb planting should be started before the old one becomes unproductive, or a renewal practice should be followed.

To keep the hills from becoming too thick and producing only slender stems the plants may be divided and reset, say every 5-7 years.

Another practice, which is considered a good one by some and a poor one by others, is to divide the crowns during the third, fourth, or fifth years by removing the soil from one side of the hill with a plow or with a sharp spade and cutting through the crown, leaving 3-4 buds undisturbed in the hill. The portion removed is usually thrown away but may be set out for increasing the rhubarb patch or field. This work should be done in the fall or early spring. In the home garden the rhubarb hills may be thinned as suggested; otherwise the crowns may become so large and so crowded with small buds that only slender undesirable stalks will be produced. Crowding the roots is believed to be a contributing factor to dropping off in yield and production of small sized petioles. By the thinning process suggested, space is provided for new root growth and a bed may continue to produce satisfactorily for 15-20 years if manured.

### **Storage**

Rhubarb stalks, if fresh and in good condition, may be stored for 2-3 weeks at 32°F. and a relative humidity of 90-95 per cent. The bunches should be packed in crates which are stacked to allow ample air circulation on all sides, otherwise there is danger of heating and also mold growth. Rhubarb freezes at 28.4°F.

### **Producing Early Outdoor Rhubarb**

In the home garden a very attractive product may be secured by placing nail kegs, small barrels or boxes open at both ends, over rhubarb roots in early spring, and surrounding same with fresh, unfermented horse manure; gunny sacks or other materials may be used for covers. Heating takes place, as in a hotbed, which results in hastened growth of leafstalks. The leafstalks will grow rapidly with slight development of the blades, and the stalks will have a rich, red color. Later, the covering may be removed and the plants allowed to develop naturally. Commercial growers obtain

somewhat similar results by placing a loose pile of strawy manure over each hill when growth has started. The mulch partially excludes the light, protects the stalks against late frosts, and produces an early product corresponding in a measure to the indoor forced article.

### Indoor Forcing

Fresh rhubarb may be had all winter by planting strong roots in the corner of the cellar in autumn after they have been dug and allowed to freeze. Four or five large roots will supply the needs of the average family. Other suitable places for forcing are the space beneath a greenhouse bench, and under exposure to light in the greenhouse. There are two distinct types of rhubarb forcing: (a) with practically all light excluded, resulting in pale or pinkish leaf stems and little development of foliage—no appreciable amount of "plant food" is taken from the air and soil; (b) under full light in the greenhouse, resulting in a naturally colored plant with medium-sized green leaves which enable the plant to assimilate food.

When plants are grown for forcing, 2-3 year roots generally are used. Older roots are often used, however, when forcing is a side line to outdoor production and also in home rather than commercial forcing. The age of the roots does not seem to influence the earliness of the crop, but the older roots often give the lightest yield.

Roots which may be forced in any darkened place where the temperature stays preferably at 50°-60°F. are: (a) specially grown 2-3 years old crowns, (b) those from which no stalks have been harvested in the current year, (c) those remaining after enough has been reserved for the spring planting of a new bed, or (d) simply those lifted from a few hills. It is especially necessary that the temperature be kept under 60°F., as higher temperatures at any stage of the forcing period may give white rhubarb. The roots force more quickly afterwards if they have been frozen; in fact, many consider that freezing is necessary for best results. The plants must not be exposed to freezing temperatures after growth has started.

The crowns should be dug before the ground freezes, then sorted and those to be forced moved near to the buildings. They are left outside until they are thoroughly frozen or at least exposed to quite severe frost for some time before being brought indoors. Roots left outside to freeze should be covered with a little soil or straw to prevent water loss by evaporation. If desirable the roots may be packed in boxes of soil before freezing and may remain in the boxes during the forcing period.

The rested clumps may be brought in early in December, and at later dates, for forcing. Freezing 2 weeks at 20°F., followed by a dormant period of 4 weeks at 30°F., where temperatures can be controlled, is an effective treatment. A rest period of 6-8 weeks is generally needed in order to get greatest yields. This rest-period of the dormant roots is easily broken and results, subsequently, in more rapid growth when heat and moisture are supplied. With a temperature of 60°F. the first harvest will be ready in 4 weeks and at 37°F. it may be delayed until 12 weeks, according to results obtained at the Lethbridge Experiment Station. The harvest may continue for 4-5 weeks, or until the roots are exhausted.

New lots may be started to force at intervals, say of 3-4 weeks, or when the stalks from the first are ready for use.

Soil is placed in a shallow layer to hold moisture. The crowns are placed in boxes (if the crowns are not too large a 56-pound butter box or similar container may be used for each, or the crowns may be packed closely together in larger boxes), or placed close together on the floor in frames built to hold them, and covered 2-3 inches above the crowns with soil, sawdust, moss, or other moisture-holding material worked in thoroughly about the rhizomes. The whole mass may be washed thoroughly. It may be necessary to supply more moisture from time to time as forced rhubarb is composed of over 95 per cent water. The soil around the roots should be kept reasonably moist but not extremely wet during the forcing period. If the roots have plenty of soil attached to them, no additional earth is used as the crowns or plants from which the stalks are to be forced have received the necessary nourishment during the season, but filling spaces between the clumps conserves moisture and gives better results. Some consider it best, however, to enrich the basic layer of soil with rotted manure though the value of this is questionable for plants forced without light.

Rhubarb forced indoors is very tender, slightly acid, and of a delicate pink to deep red color which becomes darker red the longer the rhubarb takes to force. In the dark, the yellow leafblades seldom develop to hand-size and are allowed to remain. This feature adds attractiveness to

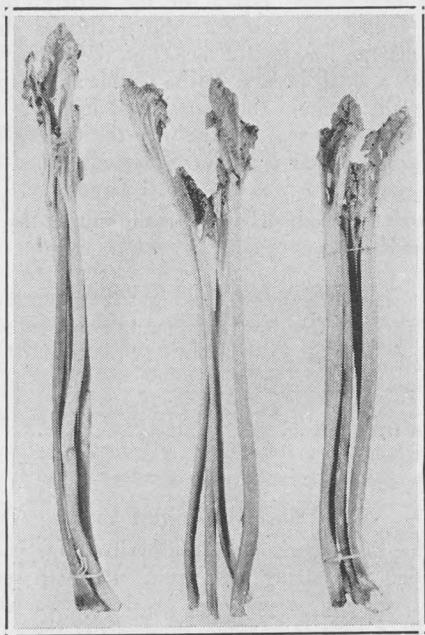


Fig. 3—The small leaves indicate that these stalks were forced in darkness.

the product and identifies it as forced rhubarb. The stalks are pulled in the same manner as the outdoor crop.

If the intention is to use the forced crowns for resetting in the field in the spring all the stored food should not be exhausted and they must not be allowed to become dry. The partly depleted crowns may be placed outdoors, allowed to freeze and be reset in the spring. They should not be forced again for several seasons, if at all.

Conditions which cause failure in attempts to force rhubarb during winter are given by Prof. Walker as follows: (a) the selection of unsuitable crowns; (b) failure to freeze the crowns before taking them indoors; (c) planting the crowns in too dry or too hot a place; (d) exposure to bright light. Another probable reason mentioned for poor results indoors is that crowns have been too severely stripped of their leaves and stalks during the previous growing season. This means weakened crowns with little reserve or stored food in the roots, which under forcing conditions cannot possibly produce many leafstalks.

### Exhibiting and Judging

For show purposes, it is suggested that the number of stalks per entry be 3, 6, or 12 (the required number should be definitely stated in the prize list). Some points to keep in mind in exhibiting and judging are (there should be separate classes for green and colored kinds):

Merits: Specimens uniform and well-matched in size, form, color, and other characters; neatly tied; typical of the variety; in harvesting, the stems should be pulled out, not cut; the leafblades should be severed neatly and immediately, leaving 1-2 inches of the midrib with intervening tissue; that is, with a small portion of the leafblade attached to the stalks; fresh; clean; smooth; medium thickness; good length (18-20 inches is a desirable length, varying to some extent with the variety); straight; tender and crisp; well colored (good red color preferred); good flavor. See also the requirements previously given for No. 1 Grade.

Faults: Not well-matched; off-type; small; wilted; dry or musty; dirty; poor quality; blemish.

#### SCORE CARD FOR RHUBARB

Condition of exhibit .....	20
Length of stalk .....	15
Thickness of stalk .....	15
Tenderness .....	20
Color .....	10
Freedom from blemish .....	15
Labelling .....	5

### Food and Medicinal Value

The chief value of rhubarb is for use by itself for sauce and pies, but it is especially good for mixing with fruit. Rhubarb seems to have the happy faculty of diluting strawberries or raspberries without destroying their flavor. Mixed with saskatoons, it improves them. It also is good mixed with black currants. Its acid properties fulfil requirements for



certain culinary purposes. In early spring, a helping of fresh stewed rhubarb is indeed a tonic.

Rhubarb is a good source of vitamin C. The value of rhubarb as an antiscorbutic (vitamin C) was first determined in 1920, by Pierson and Dutcher. Daily requirements of vitamin C are given by Drs. Pett and Cantor, Biochemistry Department, University of Alberta (Can. Med. Assoc. Jour., April, 1933), as 5-15 mg. for a child and 10-50 mg. for an adult.

Excellent sources of vitamin C are: asparagus, beet greens, broccoli, cauliflower, collards, cranberries, cress, currants, gooseberries, grapefruit, kale, kohlrabi, lemons, lettuce, limes, oranges, peas (green), peppers, pineapple, radishes, spinach, strawberries, tangerines, tomatoes, and turnip greens. Good sources of vitamin C, besides rhubarb, are: apples, bananas, beans (green), bran, Brussels sprouts, carrots, celery, chard, cherries, corn, lima beans (dried), liver, onions, peaches, pears, potatoes, raspberries, rutabagas, sprouted grain, turnips, and watermelons. The foregoing lists are based upon the vitamin C content in the fresh raw state, or when cooked carefully. Open kettle cooking, wilting, etc., may readily destroy most of the vitamin C value of foods, except the acid juices.

Clague *et al*, in Massachusetts, have shown that cooking the rhubarb into sauce caused a loss of 30-40 per cent of the antiscorbutic factor; fresh, cooked, and canned rhubarb contained 0.117, 0.032, and 0.016 mg. of ascorbic acid per gram, respectively. On a 100-gram basis, or about 3½ ounces, these figures become 11.7 mg., 3.2 mg., and 1.6 mg., respectively. Pett and Cantor state that vitamin C is the least stable of all vitamins, but owing to the occurrence of precursors or combined forms it is quite stable to canning in some foods; in other cases it is completely destroyed.

H. J. Heinz Co., Research Department, give the following information on the biological and chemical properties of vitamin C in their "Nutritional Charts" (1935):

#### *Biological properties:*

*Positive effects:* (a) Essential for normal development of endothelial cells (a layer of cells which lines cavities not directly communicating with the outside of the body, as in the interior of the heart, the blood vessels); (b) favors good tooth development; (c) improves appetite; (d) stimulates growth; (e) essential to tissue respiration; (f) controls collagen gelation (collagen is the substance which forms a principal constituent of the connective tissues, cartilage and bone); (g) essential for glandular functions; (h) protects vascular system; (i) involved in defence mechanisms against bacterial toxins.

#### *Deficiency symptoms:*

*Mild:* (a) Tender joints; (b) retarded growth; (c) defective teeth; (d) poor resistance to infections; (e) weakness; (f) restlessness; (g) digestive disturbances; (h) weakened blood capillaries; (i) poor lactation; (j) lesions in endothelial tissue; (k) headache; (l) poor bone knitting.

*Extreme:* (a) Scurvy; (b) hemorrhages; (c) swollen joints; (d) paralysis; (e) swollen gums; (f) loose teeth; (g) beaded ribs; (h) fragile bones; (i) sterility; (j) respiratory and intestinal infections; (k) lesions in bone marrow and teeth; (l) hypertrophy of adrenals (hypertrophy—morbid enlargement or overgrowth of an organ or part of the body;

adrenals—situated above, or anterior to, the kidneys); (m) atrophy (wasting away) of musculature.

*Chemical properties:* (a) Formula  $C_6H_8O_6$  (ascorbic acid); (b) very sensitive to alkalis; (c) very sensitive to oxidation; (d) fairly stable in weak acid solutions; (e) generally destroyed by drying and by cooking exposed to air, but not by cooking in steam; (f) soluble in water; (g) insoluble in oils; (h) strong reducing agent; (i) 2, 6-dichlorophenol indophenol serves as a good titrating agent; (j) shows specific absorption bands.

Rhubarb is also a fair source, but not an excellent or even a good source, of vitamin A (provitamin A—vitamin A probably does not exist in plants but conversion from certain pigments occurs in the body).

The leaf mesophyll (inner cellular tissues) and petiole (leafstalk) are practically free from starch at all stages, according to Culpepper and Caldwell. Malic acid makes up 18.25 per cent of the dry weight of the petiole. The presence of oxalic acid and nitrates are suspected of being partly responsible for the corrosive action of the material upon the metals of tin cans and aluminum utensils.

The leaves (leaf blades) contain injurious materials such as oxalic acid, and its soluble salts, and in no case should they be used for food. The content of oxalates is thought to increase towards evening. Numerous cases of more or less serious illness and some fatalities have been reported in both Europe and North America from eating rhubarb leaves. These leaf blades were eaten, boiled, in the belief that they were a suitable substitute for common greens. In the stalks, the oxalic acid is present in small amounts and largely in insoluble forms, and for this reason is harmless. Oxalic acid is poorly oxidized in the body and prevents utilization of an equivalent amount of calcium. When foods containing this acid are eaten, a high calcium intake should be maintained by eating liberal proportions of such calcium-rich foods as milk, eggs, and beans.

An analysis of rhubarb (source unknown and not as up-to-date as could be desired) is as follows: proteins, 0.6 per cent; carbohydrates, 6.6 per cent; fat, 0.7 per cent; crude fiber, 1.1 per cent; ash, 0.7 per cent; calories per pound, 105. Another analysis, that given by H. J. Heinz Co., in 1935, is as follows: protein, 0.6 per cent by weight; carbohydrate, 3.6 per cent; fat, 0.7 per cent; crude fiber, 1.1 per cent; ash, 0.7 per cent; calcium, 0.044 per cent; phosphorus, 0.031 per cent; iron, 7.6 milligrams per kilogram (parts per million); copper, 0.5 milligrams per kilogram; calories per 100 grams, 23.

Rhubarb is considered to be a *good* source of iron, though not listed as an *excellent* source. Daily requirements of iron, for both a child and an adult, are given as 0.015 per cent by Pett and Cantor. A part of this necessary requirement can be obtained by eating rhubarb. H. J. Heinz Co., in 1935, gave the following biological effects for iron:

*Positive functions*—(a) Formation of hemoglobin; (b) oxygen transport; (c) tissue respiration; (d) blood cell development; (e) normal complexation; (f) hemachromagen synthesis. *Deficiency symptoms*—(a)

Anemia; (b) low vitality; (c) decreased hemoglobin and red blood cells; (d) pallid complexion; (e) retarded growth.

Excellent sources of iron are: almonds, asparagus, beans, bran, cauliflower, celery, chard, dandelions, egg yolk, heart, kale, kidney, lettuce, liver, oatmeal, oysters, soybeans, whole wheat. Good sources, besides rhubarb, are: apricots, beans (green), beef, beets, cabbage, cucumber, currants, dates, duck, goose, lamb, molasses, oranges, parsnips, peas, peppers, potatoes, prunes, radishes, raisins, spinach, tomatoes, and turnips.

Rhubarb is usually grown for its stalks rather than for the medicinal value of its roots. When roots are to be dried for medicinal use they should not be dug up before the plants have started to become dormant. If dug earlier, or in the spring after growth starts, the roots are not of as good color. The root is used as a mild purgative, particularly when mixed with ginger.

Some claim that the juice of the leaves when rubbed well into the hands removes stains better than the juice of lemons. Also, the juice of the leaves is said to have some value for healing sores.

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